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ABSTRACT

A study was conducted to determine which of five tests used in the Early Prevention of School Failure (EPSF) program were the best predictors of student academic success at the end of first grade. The tests, which were administered upon children's entrance to kindergarten, were the Peabody Picture Vocabulary Test (PPVT), the Preschool Language Scale (PLS), the Visual-Motor Integration Test (VMI), the House-Tree-Person Test (HTP), and the Motor Activity Scale (MAS). These tests were the independent or predictor variables and were compared approximately 2 years later to scores of subtests from the Iowa Test of Basic Skills (ITBS). The five ITBS subsections considered were the vocabulary, reading, total language, work study skills, and total mathematics subsections. Subjects were 137 kindergarten children. Findings established that four of the five tests significantly predicted students' academic success: the PPVT, the PLS, the HTP, and the VMI. Children who scored low on these tests tended to score low on sections of the ITBS. (Author/RH)

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THE RELATIONSHIP BETWEEN SELECTED SKILL MEASURES OF KINDERGARTEN AND FIRST GRADE STUDENTS AND ACADEMIC SUCCESS

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ABSTRACT

THE RELATIONSHIP BETWEEN SELECTED SKILL MEASURES

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The purpose of this study was to determine which of five tests used in the Early Prevention of School Failure (EPSF) program were the best predictors of student academic success. The five tests studied were the Peabody Picture Vocabulary Test (PPVT), the Preschool Language Scale (PLS), the Visual-Motor Integration Test (VMI), the House-Tree-Person Test (HTP), and the Motor Activity Scale (MAS). These tests were the independent or predictor variables and were compared approximately two years later to scores of subtests from the Iowa Test of Basic Skills (ITBS). Specifically, the subtests which were the dependent or criterion variables were vocabulary, reading, total language, work study skills, and total math.

Canonical correlation analysis (CCA) was utilized and applied to the data collected from the independent and dependent variables (tests) to assist in determining which of the premeasures (tests) were accurate predictors of student success. The findings established that four of the five premeasures (tests) are significant predictors of student academic success. Based on the findings, if the child scored low on the PPVT, PLS, HTP, and the VMI (the independent variables), he or she would tend to score low approximately two years later on sections of the ITBS (dependent variables).

It is recommended that further testing and research be completed to substantiate these findings. Even though the MAS did not show as much predictability as the other four premeasures for the population of students in this research, further t ng and research may very well demonstrate that the MAS is a valid predictor of student academic success and/or readiness for children entering school. In addition, it is recommended that educators continue to explore pre-school measures in order to identify kindergarten students who will need additional assistance and support to be successful in school.

Overview

Educators need to identify potential dropouts early and to develop appropriate programs of study which will allow these students to experience success in school. Thus, it may be possible to decrease the dropout rate of students. Administratively, it is essential that accurate premeasures be utilized to assist in this identification in order to resolve this educational concern as soon as possible. It is well known that the "at-risk" students are the ones who have the highest probability of dropping out of school at a later date, usually between the ninth and twelfth grades.

This research provides information and statistical analysis necessary to determine which of five kindergarten premeasures are the most useful in predicting student success. It is imperative to identify accurately, at the earliest age possible, those students who may have difficulty in school.

Statement of the Problem

The problem of this research was to determine whether five tests (premeasures) administered to entering kindergarten students are valid predictors of later academic achievement.

The hypotheses tested were:

1. There is no significant relationship between success on the Peabody Picture Vocabulary Test (PPVT) and kindergarten and first grade student achievement.
2. There is no significant relationship between success on the Preschool Language Scale (PLS) and kindergarten and first grade student achievement.
3. There is no significant relationship between success on the Visual-Motor Integration Test (VMI) and kindergarten and first grade student achievement.

4. There is no significant relationship between success on the House-Tree-Person Test (HTP) and kindergarten and first grade student achievement.
5. There is no significant relationship between success on the Motor Activity Scale (MAS) and kindergarten and first grade student achievement.

Criteria for Selection of Students

A selected group of 137 kindergarten students from Luke Elementary School, Surprise Elementary School, and El Mirage Elementary School in the Dysart Unified School District were used for the study. Of the 137 students, 51% were female and 49% were male. It should be noted that almost twice as many students were administered the pre-kindergarten test; but to be part of this study, the students had to have stayed in the district for their kindergarten and first grade years and had taken the ITBS at the end of their first grade year. Of the students tested in August, 1986, 137 students took the total ITBS at the end of their first grade year in the spring of 1988. Demographics regarding age and gender are illustrated in Tables 1 and 2.

Permission was obtained from the superintendent and the governing board of the Dysart Unified School District to use the pre-kindergarten premeasure test scores for the students included in this study.

Measurement Instruments

Measurement instruments utilized in this study as predictor variables for the canonical correlations are the PPVT, the PLS, the VMI, the HTP, and the MAS. All chronological age (CA) scores on the PPVT, the VMI, and the HTP were rescaled from years and months to months only. As an example, a five-years, six-months score on the PPVT was recorded as a raw score of 66. The total raw score was used for the PLS and the MAS.

These premeasure test scores, predictor variables, were then correlated and compared with the criterion variables which are sub-test scores on the ITBS. The five ITBS subsections are as follows: the vocabulary score, the reading score, the total language score, the total work-

Table 1

Student Demographics

School	Total No. Students per School	% of Total Students	No. of Males per School	% Male	No. of Females per School	% Female
El Mirage	42	31%	23	54.7%	19	45.3%
Luke	55	40%	28	50.9%	27	49.1%
Surprise	40	29%	18	45.0%	22	55.0%
Totals	137	100%	69	50.4%	68	49.6%

Table 2

Chronological Age in Months of Students by School

School	CA From	CA To	% Total Population
El Mirage	59	72	31%
Luke	58	72	40%
Surprise	60	75	29%
			100%

study skills score, and the total math score. The normal curve equivalent scores were used in each of the related ITBS test areas.

Collection and Sources of Data

Information pertinent to the collection of data for this study is as follows:

1. The 137 students who took the entire battery of the premeasure tests, the entire battery of the ITBS, and were at the same school at the end of their first grade year comprised the group of selected students for this study.

2. All 137 kindergarten students were administered the five premeasure tests as part of the EPSF program implemented in the Dysart Unified School District.
3. The standardized ITBS was administered to each of the 137 students in April of their first grade year and was scored through the usual procedure of the State of Arizona Achievement Testing Program requirements.
4. The premeasure tests that are part of the EPSF Program were administered to each student by teachers who qualified to administer these tests through inservice programs.
5. The ITBS was administered by teachers who were authorized to administer the test.
6. All selected students have the same amount of educational time in school between the administering of the pre-kindergarten measures and the ITBS. This time span was August, 1986 through April, 1988.

Statistical Analysis

The multivariate statistical procedure used for this study was canonical correlation analysis (CCA). The procedure of canonical correlations makes it possible for the researcher to use large numbers of criterion and predictive variables with a reduction capability similar to that of factor analysis. Horner (1983) states that the canonical correlation "function is to manipulate intercorrelations among the predictive and the criterion variables to see if a particular type of patterning exists in the data" (p. 41).

Canonical correlation is a multiple regression method which adds more than one dependent variable to the multiple regression model. It is capable of showing the relations between sets of independent and dependent variables. Although it is a powerful method of analysis, it has some restrictions in its usefulness; that is, in the interpretation of the results it yields and in its limited ability to test theoretical models (Kerlinger, 1986).

One important research question is addressed by the canonical correlation: What is the relation between two sets of data with several independent variables and several dependent

variables? The idea, in other words, is to form two linear composites through least squares analysis. One of the composites is for the dependent variables, and one of the composites is for the independent variables. This correlation between the two composites is the canonical correlation, and it will be the maximum correlation possible, given the particular sets of data (Kerlinger, 1986). "In view of practical limitations on canonical analysis, it might be better to say that canonical analysis is a generalization of multiple regression analysis" (Kerlinger, 1986, p. 563).

To understand and be able to distinguish between each predictive variable, the following variable codes were assigned (Tables 3 and 4): the Peabody Picture Vocabulary Test, PPVT; the Preschool Language Scale, PLS; the Visual-Motor Integration Test, VMI; the House-Tree-Person Test, HTP; and the Motor Activity Scale, MAS. For the criterion variables from the Iowa Test of Basic Skills, the following variable codes were assigned: the vocabulary test score, VOC; the reading test score, RDG; the total language score, TLAN; the work-study skills score, WSK; and the total math score, TMATH. These variable codes, as well as codes for gender and age, are listed in Table 3 and Table 4.

Overview

The canonical correlation analysis (CCA) was utilized and applied to this study using the statistical software package SPSS-X on the Digital Equipment Corporation (DEC) VAX mainframe system at Northern Arizona University. Findings will illustrate and describe comparisons between the predictor set or independent variables and the criterion set or dependent variables. The independent or predictor variables are gender, age, PPVT, PLS, HTP, VMI, and MAS. The dependent or criterion variables are vocabulary test scores, reading test scores, total language test scores, work study skills test scores, and total math test scores from the ITBS. The tables presented with the research findings are described; it will be shown that the first pair of extracted loading vectors from the canonical correlation data were the only substantively interpretable results that showed substantial data that yielded us with objective

Table 3

Variable Numbers Referenced to the
Predictive Variables in the Study

Variables	Descriptors
V1	Sex of Student
V2	Chronological Age (CA) in Months
V3 (PPVT)	Peabody Picture Vocabulary Test Score (Age in Months)
V4 (PLS)	Preschool Language Scale Score (Total Raw Score)
V5 (VMI)	Visual-Motor Integration Test Score (Age in Months)
V6 (HTP)	House-Tree-Person Test Score (Age in Months)
V7 (MAS)	Motor Activity Scale Score (Total Raw Score)

Table 4

Variable Numbers Referenced to the
Criterion Variables in the Study

Variables	Descriptors
V8 (VOC)	Iowa Test of Basic Skills Test Score (Vocabulary)
V9 (RDG)	Iowa Test of Basic Skills Test Score (Reading)
V10 (TLAN)	Iowa Test of Basic Skills Test Score (Total Language)
V11 (WSK)	Iowa Test of Basic Skills Test Score (Total Work Study Skills)
V12 (TMATH)	Iowa Test of Basic Skills Test Score (Total Math)

data for conclusions regarding this study. Tables 5, 6, and 7 illustrate and provide the information necessary to formulate objective conclusions for this study. Table 5 is the table of *Variates, Associated Eigenvalues, and Summary of Canonical Correlation Output*. Table 6 shows the *Variance Accounted for in the Dependent (Criterion) Set of Variables*. Table 7 illustrates the *First Pair of Extracted Canonical Variates and Associated Loadings*. Table 7 in association with Tables 5 and 6 will provide the background data from the canonical correlation statistical analysis needed to develop the final conclusions.

Variates, Associated Eigenvalues, and Summary of Canonical Correlation Output

Data in Table 5 illustrate the associated eigenvalues for the five pairs of extracted variates. The only pairing that was robust and resulted in significance was the first pairing of variates that had an associated eigenvalue of .94124. This is a strong eigenvalue and illustrates that there may be significance in the first pairing of variates. The other four pairings were not robust and were not significant enough to develop and draw any conclusions that would provide any objective information for the study; that is, they did not account for substantial additional variance in responses.

The canonical correlation coefficient is the correlation between two sets of variables. In Table 5 the canonical correlation coefficient for the five pairings is listed. These correlations show that there was only one pairing that provided robust data and provided good predictive information. This was the pairing that provided a canonical correlation coefficient of .69632; that is, the same pairing that yielded a significant eigenvalue of .94124.

The canonical square root is also illustrated in Table 5 for the five sets of pairings. The square root shows the amount of shared variance or overlap between sets of predictors or independent variables and criterion or dependent variables. The five canonical root pairings from this study were .48487, .12952, .07058, .02649, and .00365 respectively. In pairing number one, the canonical square root .48487 for the first pair reduced the variance, or set of variates uncertainty, by one half. Again, as with the eigenvalue and the canonical correlation

Table 5

Variates, Associated Eigenvalues, and Summary of Canonical Correlation Output

Variate	Eigenvalue	Canonical Correlation Coefficient	Squared Canonical Correlation
1	.94124	.69632	.48487
2	.14879	.35988	.12952
3	.07594	.26566	.07058
4	.02721	.16274	.02649
5	.00367	.06044	.00365

coefficient, the first pairing was the only set of pairs that provided significant information and robust interpretable data.

The statistical analysis results illustrated in the three tables make it increasingly clear that the first pairing was the only pairing providing significant data.

Variance Accounted for in Dependent (Criterion) Set of Variables

Table 6 displays the variance accounted for in the dependent or criterion set of variables. The canonical variates and the specific percent of variance accounted for in the five dependent variables are presented in Table 6.

The first pair, or profile, accounted for over three quarters (77.49835) of the variance to be explained in the five dependent variables (the premeasure tests). As with the eigenvalue and the canonical correlation coefficient illustrated in Table 3, the first pair is the only pair that showed a significant percent of variance of all the pairs of profiles. As can be easily seen, there is a significant drop in the percent of variance accounted for from pairing to pairing. From the first pair there is approximately 77.5% to the next highest variance which is the third pair at 6.75%. Again, it is easy to see that the first pair or profile is extremely

Table 6

Variance Accounted for in Dependent (Criterion) Set of Variables

Canonical Variate	Percent Variable Accounted For	Cumulative Percentage of Variance Accounted For
1	77.49835	77.49835
2	6.27245	83.77082
3	6.74906	90.51988
4	5.46141	95.98128
5	4.01872	100.00000

robust and the percent of variance accounted for shows a strong degree of significance for this study.

First Pair of Extracted Canonical Variates and Associated Loadings

Table 7 compares the first pair of extracted canonical variates and the associated loadings of the independent or predictor variables and the dependent or criterion variables. For interpretive significance one is looking for loadings in the first pair that has an absolute value of .5 or above. In reviewing the predictor variables, there is an absolute value of .5 or above for the PPVT, the PLS, the VMI, and the HTP. These four scores are significant and were used to draw specific conclusions for this study. The MAS with a negative .37036 is not significant and will not be used.

In the loadings for the dependent or criterion variables, all variables had an absolute value of .5 or above. Thus, the vocabulary, reading, total language, work study skills, and the total math scores from the ITBS were significant.

Table 7
First Pair of Extracted Canonical Variates
and Associated Loadings

Independent/ Predictor Variables	Loadings First Pair	Dependent/ Criterion Variables	Loadings First Pair
Gender	.13416	Vocabulary	-.76843
Age	.06274	Reading	-.91583
PPVT	-.76008	Total Language	-.89582
PLS	-.53254	Work Study Skills	-.90786
VMI	-.66526	Total Math	-.90498
HTP	-.64057		
MAS	-.37036		

In interpreting this table, it must be pointed out that the negative sign in front of the loadings of the predictor and the criterion variables illustrate that this is a comparison for students who scored low on the predictor test and the criterion test.

Conclusions

The conclusions are based on the analysis of the data collected. Each null hypothesis will be discussed individually. Table 7 provided the statistical information from which the conclusions are drawn.

1. There is no significant relationship between success on the PPVT and kindergarten and first grade achievement. The null hypothesis must be rejected. The absolute value loading of .760 shows significance. Kindergarten students who score low on the PPVT will also score low at the end of the first grade on the vocabulary, reading, total language, work study skills, and total math sections of the ITBS.
2. There is no significant relationship between success on the PLS and kindergarten and first grade student achievement. The null hypothesis must be rejected. The absolute

value loading of .533 shows significance. Kindergarten students who score low on the PLS will also score low at the end of the first grade on the vocabulary, reading, total language, work study skills, and total math sections of the ITBS.

3. There is no significant relationship between success on the VMI and kindergarten and first grade student achievement. The null hypothesis must be rejected. The absolute value loading of .665 shows significance. Kindergarten students who score low on the VMI will also score low at the end of the first grade on the vocabulary, reading, total language, work study skills, and total math sections of the ITBS.
4. There is no significant relationship between success on the HTP and kindergarten and first grade student achievement. The null hypothesis must be rejected. The absolute value loading of .641 shows significance. Kindergarten students who score low on the HTP will also score low at the end of the first grade on the vocabulary, reading, total language, work study skills, and total math sections of the ITBS.
5. There is no significant relationship between success on the MAS and kindergarten and first grade student achievement. The null hypothesis must not be rejected. The absolute value loading of .370 is less than .500, and does not show significance. Kindergarten students who score low on the MAS do not necessarily score low at the end of the first grade on the ITBS.
6. Findings from this research indicate that gender has no real impact on predicting the students' success or achievement. The statistical result for gender loading, .13416, is considerably short of the absolute value .5 that is necessary to show any significance.
7. In addition, statistical information from this research indicates that age is not a significant factor in predicting student achievement for this population of students. The loading for age, .06274, is the lowest in the first pair of comparisons, although it varies in other pairs. Age/gender are irrelevant when comparing scores where students score low on the predictor variables with scores on the dependent or

criterion variables. This researcher questions the lack of strong significance associated with age and feels further research may result in different conclusions.

Statistics from this study do not point out any correlation or significant conclusions that indicate a student who scores high on any of the premeasures would academically function well and score high on the ITBS. This researcher does not believe this possibility should be ruled out, and further research may show a correlation of this type exists.

As educators continually strive to find assessment tools, activities, and procedures to identify students who may have learning problems in school, it is critical for educators to use valid educational premeasures. The results from this study, according to this researcher's findings, illustrate and support the validity of the EPSF program as a tool for educators to utilize to help identify students who may be at-risk as they start and continue through school.

As the results of this research are summarized and the researcher draws conclusions, the following needs to be considered by those reviewing this research. The 137 students who made up the population of this study were students who scored high enough on the five premeasure tests of the EPSF program to be placed in a regular academic kindergarten classroom in the Dysart Unified School District and not in a developmental kindergarten program. The developmental kindergarten program was a two-year kindergarten program for students demonstrating the need for special educational assistance. In other words, students in the study who were identified as having scored low on the premeasure tests were actually in the low range of students who scored high enough to enter a regular academic kindergarten program in the Dysart Unified School District. This is one of the main limitations of the study.

The results of this study indicate to this researcher that the PPVT, PLS, HTP, and VMI are valid premeasure tests which can determine when entering kindergarten the potential academic achievement of students in at least the first two years of school. In addition, it may be concluded that the EPSF program is a valid program for determining student achievement and identifying students who will need additional academic support as they progress through school. As stated, it is extremely important for educators to find assessment tools, tests, procedures,

and programs that will assist in early identification of potential at-risk students. As educators know, many problems and variables enter into a student being at-risk and the earlier these variables can be isolated, the students identified, and remediation begun to alleviate the variables and resultant problems, the more success the children will have as they proceed through their years of education.

Implications for Practitioners

There are many far-reaching implications for practitioners that can be derived from the results of this study. Several of the most important will be discussed in this section.

What can educators do with students who score low on entry-level assessments such as the premeasure tests in the EPSF program but not low enough to be placed in a remedial program such as a developmental kindergarten? How do educators reach these students? Will these students continue to be lost academically year after year as they progress through school? In this study, students who scored low on four of the five premeasures also tended to score low on the ITBS subtests given after almost two years of school. Therefore, it could be concluded that whatever academic steps educators take during the two years in the interim does not significantly improve the academic ability of these students.

Do remediation programs such as resource LD, speech, and so forth for students in regular academic programs help students achieve academically? Not only must educators be able to assess, identify, and diagnose the students who are going to be at-risk and need additional help, educators must be able to effectively remediate all areas of educational deficiencies and provide students with the foundation necessary to achieve and continue to progress in school.

How do educators find the key, the educational technique necessary to academically reach out to remediate students who are low? What should be done to continue to assist these students during their primary and elementary years?

Do educators continue to provide the same educational methods and procedures that appear not to have worked or do they restructure educational techniques and programs available

for these students? It is imperative that our educational system is restructured to provide the programs and instruction necessary to help students build on the foundation they bring to school to be able to succeed throughout their educational years.

Children must be academically successful in order to enter the work force and become responsible, respected citizens. Are educators ensuring this outcome of the educational process? This researcher feels we are not. It is sad to find that the students who scored low on the premeasures also scored low on an assessment two years later.

Educators must have valid assessments to help us identify students at-risk academically. Equally important, perhaps even more so, educators must help these students succeed in school and become successful citizens as adults.

Recommendations

The findings of this study determined that there is a strong correlation between four of the premeasures and later success on the ITBS. Further, it was discovered that there was little or no significance for age and gender attached to success on the ITBS.

Recommendations for Further Study

1. This study should be replicated using a population whose demographics are different from those of the Dysart Unified School District.
2. This study should be replicated with further research conducted on the predictive value of the MAS, as this researcher feels that the MAS is a valid predictor of student success, shown with the other four premeasures.
3. This study should be replicated using a test of significance specifically for age.
4. This study should be replicated using a test of significance specifically for gender.
5. This study should be replicated longitudinally in order to determine whether the results remain similar as students reach higher grades.

6. Research should be conducted to determine whether remediation or academic programs are effective for lower achieving students after they are identified in the current educational setting.

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